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STRUCTURAL CHANGE AND INCOME DISTRIBUTION: ACCOUNTING FOR REGIONAL INEQUALITY IN THE PEOPLE'S REPUBLIC OF CHINA AND ITS CHANGES DURING 1952–2012

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ADB recognizes "China" as the People's Republic of China.

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Abstract

This study explores the relationship between inequality and structural transformation by constructing a theoretical model, developing analytical frameworks, and implementing a case study. The general equilibrium model we develop demonstrates that inequality exhibits an inverted U shape as structural change proceeds from onset to completion. Our analytical frameworks enable decomposition of total inequality into sector contributions and a change in total inequality into a component attributable to structural transformation and the other component to concentration or spatial agglomeration. Applying the decomposition frameworks to data from the People's Republic of China yield various interesting findings and more importantly confirms the inverted U shape as predicted by our theoretical model.

JEL Classification: D63, O53, R12, O18

Contents

1. INTRODUCTION

Given the relationship between inequality and growth (Lewis 1955; Kuznets 1955; Williamson 1965; Huw and Bernhardt 2000) and the well-recognized link between growth and structural change (Laitner 1999; Echevarria 1997; Fan, Zhang, and Robinson 2003), it is natural to ask if and how structural transformation affects income distribution. The special significance of exploring the structural change–inequality nexus lies in that structural transformation is almost indispensable to long-run economic growth in both developing and developed economies. Therefore, inequality changes that are attributable to structural transformation, if existent, form part of the growth regularity and are inevitable. On the other hand, structural transformation is a transitional process. Consequently, any inequality change associated with structural transformation is expected to disappear once the latter is complete. It follows that policy interventions to contain or curb this component of inequality changes are unnecessary.

Despite its theoretical and empirical significance, little research attention has been focused on the inequality–structural change nexus, although there are many studies on income distribution or structural transformation separately. For the case of the People's Republic of China (PRC), see Wan (2008a, 2008b) and Wang, Wan, and Yang (2014) on income distribution and Dekle and Vandenbroucke (2011) on structural transformation. The classic works of Kuznets (1955) and Lewis (1955) focus on the relationship between *growth* (not structural change per se) and inequality, which is largely applicable to developing economies only. Structural change, however, is a common feature of all economies.

This paper contributes to the literature by developing a general equilibrium model, demonstrating a relationship of inverted U shape between inequality and structural change. Decomposition frameworks are then derived that can be used to identify (i) sectoral contributions to total inequality and (ii) the changes in inequality attributable to structural transformation (the structural component) and to concentration or spatial agglomeration (the concentration component). Finally, we apply the decomposition frameworks to data from the PRC.

The PRC offers an excellent opportunity for investigating the structural change–inequality nexus. Policy shocks initiated in late 1978 and a series of reforms implemented in the following years led to significant structural transformation, meaning large-scale resource flows across locations and sectors. In particular, the huge number of rural-to-urban migrants in the PRC, now estimated in the order of 270 million, would have been unemployed or underemployed in the absence of such structural changes. Holding everything else constant, such structural transformation is expected to help reduce inequality, as those migrants who were most likely to be under- or unemployed now earn decent income. Of course, in reality little can be held constant. In fact, inequality in the PRC has risen rapidly, leading to serious and multiple socioeconomic problems. Clearly, identifying and quantifying the impacts of structural change on inequality will help provide valuable policy implications for the PRC government and possibly other institutions.

In addition to confirming the relationship of inverted U shape predicted by our theoretical model, other major empirical findings of this paper include: (i) Regional inequality in pre-reform PRC was broadly trendless while a rising trend emerged after reforms that began in late 1978. (ii) Structural transformation was the main driver of regional inequality before 2004 but spatial concentration or agglomeration became the dominant component after 2006. (iii) The structural and

concentration components tended to reinforce each other until 1972 and offset each other during 1973–1985. They seem uncorrelated in other years. (iv) The agriculture sector had been always inequality-reducing while the service sector almost always dis-equalizing. The manufacturing sector accounted for more than half of total regional inequality before the mid-1990s, but this role was taken over by the service sector after the mid-2000s. (v) The service industry has been spatially diverging since the early 1980s. By the mid-2000s, it overtook the secondary industry as the most important contributor to regional inequality. From 1994 to 2003, all increases in total regional inequality came from the tertiary sector.

Before proceeding further, it is useful to mention the study by Caselli and Coleman (2001), which may appear to be closely related to this study. However, our paper differs from theirs in several aspects: (i) We consider only one economy, and model the entire process of inequality evolution due to structural change caused by technological or other shocks, while they consider multiple regional economies of the United States (US) and focus on income convergence (not the entire process of inequality change) driven by reductions in education cost. (ii) We focus on divergence and convergence in inter-sector gaps while they focus on convergence in total income across regions. Thus, the steady state or completion of structural transformation in our paper implies disappearance of inter-sector gaps, not necessarily convergence in total income. The steady state in their papers means disappearance of gaps in total income, inter-sector income, and economic structure across regions. (iii) As far as empirical application is concerned, we account for the level as well as changes in regional inequality in the PRC, while they explain the declining gaps in income level and economic structure across regions in the US.

The plan of our paper is as follows. Section 2 presents graphical illustrations and a theoretical model demonstrating how technology shocks cause structural change that, in turn, induces an inverted U shape of inequality. Section 3 proposes decomposition techniques for identifying and measuring sector contributions to total inequality and the contribution of structural transformation to a change in inequality, where inequality is indicated by the popular Gini coefficient. In Section 4, the proposed decomposition techniques are applied to provincial gross domestic product (GDP) data from the PRC, confirming the inverted U shape and providing several fresh and insightful empirical findings. Section 5 concludes.

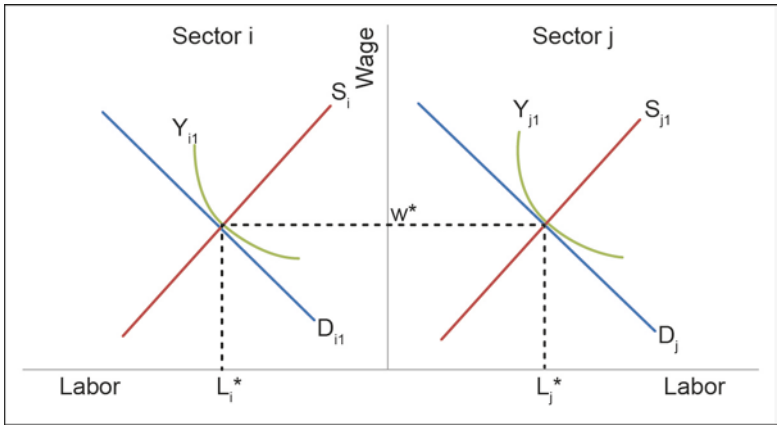
2. THE STRUCTURAL CHANGE–INEQUALITY NEXUS

Structural change can occur in any economy at any stage of its development. Broadly speaking, it often refers to the process of industrialization or rising dominance of the service sector. But structural transformation can and increasingly does take place at a more disaggregated level of industry classification. For example, the information technology shock not only led to the creation of the information and communication technology industry but also has exerted tremendous impacts on many other sectors such as telecommunication and banking services. It has certainly caused disequilibria in the labor markets for many years and generated significant wage premiums for information and communication technology professionals in the early days. Those who stepped into this sector early enjoyed higher remuneration, leading to significant inter-sector wage gaps. As another example, the policy shocks initiated in the late 1970s of the PRC (see section 4 of this paper for more discussion) led to significant structural changes, affecting urban–rural income disparity and possibly increasing inequalities within rural and urban areas, too.

Beneath any structural transformation are the flows of resources, such as labor and capital, across industries and locations. For example, as nonfarming sectors boom and the primary sector shrinks in the PRC, hundreds of millions of laborers have migrated from rural areas to the cities, from agriculture to jobs in the manufacturing and service sectors, and from inland to coastal regions. Such large-scale migration, unprecedented in human history, is largely driven by disequilibria in factor markets amid structural transformations. As a stylized fact, surplus rural labor and rising demand of nonagriculture sectors for low-skilled labor coexist in almost all emerging economies, implying that both rural and urban labor markets can be in disequilibrium.

To illustrate, assume an economy with two sectors (sectors *i* and *j*). Figure 1(a) shows the economy at the initial equilibrium with labor inputs L_i^* and L_j^*, as determined by labor demand *D* and supply *S*, appropriately indexed. Both sectors pay the same wage *W** and there is no inequality.

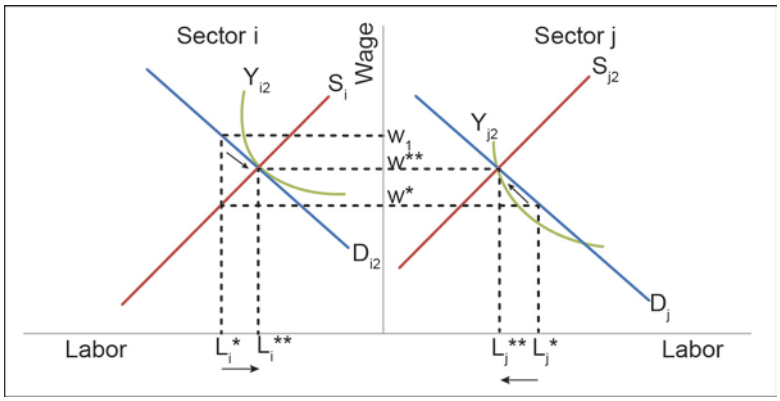
Figure 1(a): Structural Change and Inequality: Initial Equilibrium



Source: Authors' adaptation.

Now there comes a technological, cultural, institutional, or policy shock, which shifts labor demand in sector *i* upward from D_{i1} to D_{i2} in Figure 1(b). This, in the short run, will lead to an increase of wage in sector *i* to W_1, because labor supply cannot adjust to the demand change due to skill mismatch, job transfer or adjustment costs, and so on. Wage or income inequality thus emerges. The wage difference, of course, will induce labor flows from sector *j* to sector *i*, as indicated by the arrows under the horizontal axis in Figure 1(b).

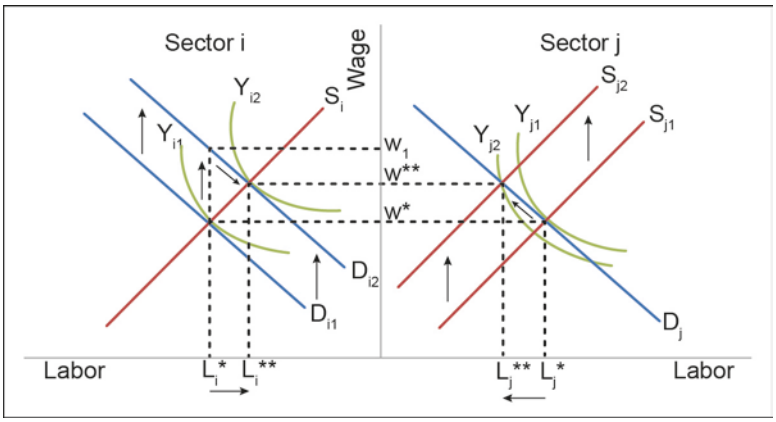
Figure 1(b): Structural Change and Inequality: Disequilibrium



Source: Authors' adaptation.

This labor flow, likely to be a gradual process, will eventually lead to a new equilibrium, with same wage *W*** in both sectors, as shown in Figure 1(b). Contrasting Figures 1(a) and 1(b), output and input(s) in sector *i* grow but they decline in sector *j*, implying structural change. Figure 1(c) shows the entire process.

Figure 1(c): Structural Change and Inequality: The Transition Process



Source: Authors' adaptation.

The above depicts a relationship of inverted U shape between inequality and structural change, holding everything else constant. At the onset of a structural change (disequilibrium), inequality rises but then decreases as structural transformation approaches completion. Of course, inequality often persists since structural transformation could last for a long time, particularly when markets are fragmented, as in the PRC. It is useful to reiterate that this inverted U shape is applicable to both industrialized and developing economies provided structural changes of any kind take place. Such a pattern between inequality and structural transformation is different from, although related to, the Kuznets hypothesis, which intends to establish a *growth*–inequality relationship. The mechanism underlying the Kuznets hypothesis is also different. As Lewis (1955) pointed out, growth usually does not take place everywhere and not everyone is positioned to gain from growth at the same rate. As a consequence, growth often comes with rising inequality. Kuznets (1955) offered

anecdotal evidence on and discussed why the growth–inequality relationship may exhibit an inverted U shape.

The graphical illustration is informative but unrealistic. In reality, it is rare to have complete equilibrium to begin with. That is, the initial inequality is unlikely to be nil. In addition, for many developing economies, the urban–rural gap is typically large and surplus labor exists in relatively lagging rural areas with an almost horizontal labor supply curve. In this case, flows of labor from rural to urban sectors will help raise rural income (e.g., via remittances and increased resources per unit of labor in rural areas) while keeping urban wages from rising. Even in mature economies, inter-industry wage gaps persist.

To formalize the structural change–inequality nexus, without the unrealistic assumption of initial wage equality and other limitations of the graphical illustration, we begin with a simple variant of the standard two-sector dynamic equilibrium model. For easy exposition, we will call these sectors a traditional and a modern sector. The economy is populated by overlapping generations of two-period-lived agents. All agents only work for one period in a sector of their choice. Moving from one sector to another incurs migration costs.

Production

The traditional sector is labor intensive and uses labor as the only input. The modern sector uses both capital and labor for production and is subject to shocks such as technological advances or institutional reforms. The products of both sectors can be either consumed or saved for future capital formation.

Let *t* index time, *r* index the traditional sector, *Y* denote value of output, and *L* denote labor input. The production function of the traditional sector takes a simple form where one unit of labor produces one unit of output (Gollin et al. 2002; Yang and Zhu 2013):

$$Y_{rt} = L_{rt} \tag{2.1}$$

The labor is paid its value of marginal product, thus the wage of the traditional sector can be expressed as:

$$w_{rt} = 1 \tag{2.2}$$

The modern sector is characterized by the standard Cobb–Douglas production function:

$$Y_{mt} = AK_t^{\alpha} L_{mt}^{1-\alpha} \tag{2.3}$$

where *m* indexes the modern sector, α denotes the capital share, and A denotes total factor productivity. Capital stock, denoted by K_t, is assumed to be accumulated using both outputs Y_{rt} and Y_{mt} and is fully depreciated within the first period. And the wage of the modern sector becomes:

$$w_{mt} = (1-\alpha) AK_t^{\alpha} L_{mt}^{-\alpha} \tag{2.4}$$

Using r_t to denote the return to capital, we have:

$$r_t = \alpha AK_t^{\alpha-1} L_{mt}^{1-\alpha} \tag{2.5}$$

Total labor supply L is:

$$L = L_{rt} + L_{mt} \tag{2.6}$$

Following Caselli and Coleman (2001), economic structure v_t can be defined as the ratio of the labor force in the modern sector to the total labor force, which closely reflects the output share of the modern sector:

$$v_t = L_{mt}/L \tag{2.7}$$

Preference

There is a representative overlapping-generation agent with time separable and non-homothetic preferences defined over the per capita consumption of goods:

$$U_{i,t} = ln\left(c_{i,t}^t\right) + \beta ln\left(c_{i,t+1}^t\right), i = r, m \tag{2.8}$$

where c_{t+1}^t represents the goods consumed by the *t*-th generation of the agent at time *t+1*. β is the rate of time preference. The budget constraint is given by:

$$c_{i,t}^t + \frac{1}{r_{t+1}} c_{i,t+1}^t = w_{it} \tag{2.9}$$

where w_{it} is the wage income of the representative agent in sector *i*. The solutions of the utility maximization problem are given by:

$$\begin{cases} c_{i,t}^t = \frac{1}{1+\beta} w_{it} \\ c_{i,t+1}^t = \frac{\beta}{1+\beta} r_{t+1} w_{it} \end{cases} \tag{2.10}$$

Agent saving is:

$$s_{it} = w_t - c_{i,t}^t = \frac{\beta}{1+\beta} w_{it} \tag{2.11}$$

Labor Transfer Decision

Agents maximize utility. They make labor transfer or migration decisions based on utility differences between the two sectors. By manipulating (2.10), we can show that such utility differences are simply their wage differences. Therefore, labor transfer will occur as long as $w_{mt} > w_{rt} = 1$. As argued by Harris and Todaro (1970) and Chau (1997), however, labor transfer is not cost-free. Nonmonetary costs such as loss of social capital, psychological obstacles, and adaption to new job and living environments are inevitable. In this paper, the costs of labor transfer are considered as a reduction in the utility of agents, denoted by *D*. Thus, in equilibrium, we have:

$$U_r^t = U_m^t - D \tag{2.12}$$

Combined (2.8) and (2.12), we can solve for the labor market equilibrium as:

$$w_{mt} = \tau w_{rt} = \tau \tag{2.13}$$

where $\tau \triangleq \exp\left(\frac{D}{1+\beta}\right) > 1$. (2.13) is similar to the assumption of Ros (2000), but we derive rather than assume (2.13) by solving the utility maximization problem. Coincidently, τ is equivalent to the wage or income ratio between the modern and

traditional sector. It is clear that the presence of the transfer costs has distributive implications. The larger the transfer costs are, the wider the sector wage gap would be.

After some manipulations using (2.4) and (2.13), we can obtain:

$$k_t = \left[\frac{\tau}{(1-\alpha)A}\right]^{\frac{1}{\alpha}} v_t \tag{2.14}$$

where k_t is capital per unit of labor.

Equilibrium

In the equilibrium, markets for labor, final product, and capital should be clear. The labor market equilibrium is described by (2.14). According to Walras' law, as long as the capital market is clear, the markets of the final products would be clear automatically.

The capital market equilibrium is simply given by the capital accumulation function:

$$K_{t+1} = s_{rt} L_{rt} + s_{mt} L_{mt} \tag{2.15}$$

where s_r and s_m denote savings rates. Using the saving function of (2.11), we have:

$$k_{t+1} = \frac{\beta}{1+\beta}(1 - v_t + \tau v_t) \tag{2.16}$$

The two-sector equilibrium is attained when equations (2.5), (2.14), and (2.16) are satisfied.

Steady State

Substituting (2.14) into (2.16), we obtain:

$$k_{t+1} = \frac{\beta}{1+\beta}\left\{1 + (\tau - 1)\left[\frac{(1-\alpha)A}{\tau}\right]^{\frac{1}{\alpha}} k_t\right\} \tag{2.17}$$

According to the fixed point theorem, the steady state exists if and only if:

$$\frac{\beta}{1+\beta}(\tau - 1)\left[\frac{(1-\alpha)A}{\tau}\right]^{\frac{1}{\alpha}} < 1 \tag{2.18}$$

Under this condition, the steady states of capital per unit of labor, the economic structure, and return to capital are:

$$\bar{k} = \frac{\beta}{1+\beta}\left\{1 - \frac{\beta}{1+\beta}(\tau - 1)\left[\frac{(1-\alpha)A}{\tau}\right]^{\frac{1}{\alpha}}\right\}^{-1} \tag{2.19}$$

$$\bar{v} = \frac{\beta}{1+\beta}\left\{\left[\frac{\tau}{(1-\alpha)A}\right]^{\frac{1}{\alpha}} - \frac{\beta}{1+\beta}(\tau - 1)\right\}^{-1} \tag{2.20}$$

$$\bar{r} = \frac{\alpha\tau}{1-\alpha}\left[\frac{(1-\alpha)A}{\tau}\right]^{\frac{1}{\alpha}} \tag{2.21}$$

According to (2.20), any shocks to the production function (2.3) will lead to structural change. When A = 0, no output is produced by the modern sector and this is consistent with (2.20) showing:

$$\bar{v}(A = 0) = 0 \tag{2.22}$$

Since $\frac{d\bar{v}}{dA} > 0$ under (2.20), as A increases, so will the degree of structural change. Specially, we have:

$$\bar{v}\left[A = \frac{\tau}{(1-\alpha)}\left(\frac{1+\beta}{\beta\tau}\right)^{\alpha}\right] = 1 \tag{2.23}$$

Equation (2.23) represents the completion of structural change.

The Structural Change–Inequality Relationship

Since we focus on the structural change–inequality nexus, within-sector inequalities are assumed to be nil or constant. Using the Gini coefficient *G* as the inequality indicator, we have:[1]

$$G = \frac{w_m L_m}{w_r L_r + w_m L_m} - \frac{L_m}{L} \tag{2.24}$$

Substituting (2.7) and (2.13) into (2.24) yields:

$$G = \frac{(\tau-1)v(1-v)}{1-v+\tau v} \tag{2.25}$$

Clearly, the inequality depends on the sector wage ratio and economic structure.

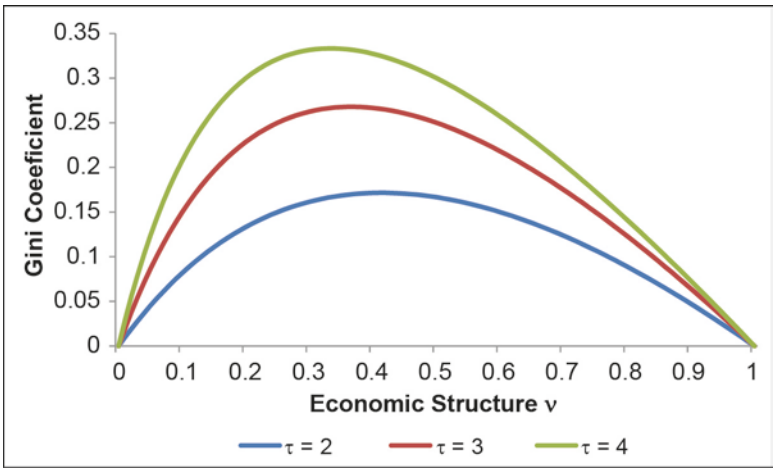
To explore the relationship between inequality and structural change, we take the first-order derivative:

$$\frac{dG}{dv} = \frac{\tau}{(1-v+\tau v)^2} - 1 \tag{2.26}$$

Since $\frac{dG}{dv}(v = 0) = \tau - 1 > 0$, $\frac{dG}{dv}(v = 1) = \frac{1}{\tau} - 1 < 0$, and $\frac{d^2G}{dv^2} < 0$, inequality as represented by the Gini coefficient exhibits an inverted U shape as structural change takes place. Figure 2 illustrates this inverted U shape using hypothetical wage or income ratios between sectors. Such ratios are commonly observed between the rural and urban sectors in developing countries (Shorrocks and Wan 2005).

[1] See the appendix for detailed derivation of the two-sector Gini coefficient.

Figure 2: Inequality and Structural Change



Source: Authors' calculation.

To sum up, both our graphical illustration and theoretical model demonstrate an inverted U shape between inequality and structural transformation whereas the latter is often triggered by shocks to sector production function(s) such as technical progress, policy reforms, or significant transborder events. Any positive shock will bring in a temporary wage increase to the relevant sector, leading to changes in inequality or wage gaps, which induce labor transfers. Such transfers will help gradually restore equilibriums in the labor markets of all sectors. Consequently, the wage gaps will narrow over time. When the structural change comes to completion, its impact on inequality change disappears.

3. ACCOUNTING FOR INEQUALITY AND ITS CHANGES: THE ROLES OF ECONOMIC STRUCTURE AND STRUCTURAL TRANSFORMATION

It is important to point out that structural changes may be accompanied by changes in inequality within sectors and that inequality could be driven by forces other than structural transformation. These forces determine the levels of inequality before the onset, as well as after the completion, of a structural change. Thus, the structural transformation–inequality relationship is complex and may vary over time and from economy to economy. The analytical challenge lies in how to disentangle the contribution of structural transformation to an overall change in total inequality, an issue to be addressed in this section.

Consistent with the theoretical model in section 2, inequality will be measured by the popular Gini coefficient. A particular advantage of the Gini coefficient was shown by Dagnum (1990), who proved that the social welfare function underlying the Gini coefficient is an increasing function of the mean income and a decreasing function of income inequality. In contrast, other inequality measures, including the generalized entropy family and Atkinson measures, generally imply decreases in social welfare following a drop in income of an economic unit irrespective of what might happen to the overall income distribution.

One way of computing the Gini coefficient is to follow Silber (1989):

$$G_d = PQI \tag{3.1}$$

where G_d denotes the Gini estimate, P is a row vector containing the shares of income-receiving units, and I is a column vector containing the corresponding income shares. Both are ranked by increasing values of per capita income of the income-receiving units. Finally, Q is a square matrix with appropriate dimensions with $q_{ij} = 0$ if $i = j$, $q_{ij} = 1$ if $i < j$, and $q_{ij} = –1$ if $i > j$.

Now, suppose total income Y is composed of K sources or components, i.e., $Y = Y_1 + Y_2 + ... + Y_K$. When equation (3.1) is applied to a particular source of income Y_k, the corresponding Gini ratio, denoted by G_k, indicates inequality in the k-th factor income and can be computed using the following equation:

$$G_k = P_k Q I_k \tag{3.2}$$

where P_k is a row vector of shares of income-receiving units who receive Y_k, and I_k is a column vector of income shares computed using data on the k-th component income. Both are ranked by increasing values of per capita component income Y_k (not per capita total income Y). When the P_k and I_k vectors are ranked by increasing values of per capita total income Y instead of Y_k, one obtains the concentration index C_k:

$$C_k = P_k^* Q I_k^* \tag{3.3}$$

where P_k^* and I_k^* contain the same elements as P_k and I_k do, but these elements are now ranked by increasing values of per capita total income Y, not component income Y_k. Thus, $C_k = G_k$ if and only if the ordering of the total income and that of the k-th component income are the same. While any Gini ratio G_k or G_d takes value in the interval (0, 1), C_k lies between $–G_k$ and G_k (Kakawin 1977, p. 721).

It is useful to note that $C_k < 0$ means that source income k is negatively correlated with total income. In this case, the poor receive more Y_k than the rich. And an increase in the k-th source income, holding its distribution unchanged, will help moderate total inequality. In fact, $C_k < 0$ overstates the condition for the k-th income to be inequality-reducing. The k-th income is inequality-reducing as long as $C_k < G_d$ (Podder and Chatterjee 2002). The contrary is true when $C_k > G_d$.

Let u and u_k denote the mean of the total income and the mean of the k-th component income, and G_d can be expressed as (Kakwani 1977: 724):

$$G_d = \sum_k C_k u_k / u = \sum_k S_k C_k \tag{3.4}$$

where $S_k = u_k/u$ denotes the share of the k-th income in total income. Thus, the Gini coefficient can be interpreted as a weighted average of K concentration indices, using the income shares as weights.

Equation (3.4) can be used to explore the composition of a Gini estimate, providing insights on which income source deserves more consideration in the fight against inequality. It follows that $S_k C_k / G_d$ represents the percentage contribution of component income k to the overall income inequality.

However, a dominant contributor in terms of inequality composition may not be a major contributor to a change in inequality. An analogous case is the distinction between sources of economic growth and the composition of an economy. For example, agriculture may represent a major component of a developing economy, but economic growth could come largely from nonagriculture sectors. Similarly, the unequal

distribution or spatial concentration of the manufacturing industry may dominate the overall regional inequality in the PRC, but it might be a small contributor to changes in regional inequality.

To disentangle the contribution of various income sources to an inequality change, let $\Delta G_d = G_{d\,t+1} - G_{d\,t}$ and similarly defining ΔS_k and ΔC_k. The Gini coefficient in period *t* can then be expressed as:

$$\begin{aligned} G_{dt} &= \sum\nolimits_k S_{kt} C_{kt} \\ &= \sum\nolimits_k (S_{kt+1} - \Delta S_k)(C_{kt+1} - \Delta C_k) \\ &= G_{dt+1} - \textstyle\sum_k (S_{kt+1}\Delta C_k + C_{kt+1}\Delta S_{kt} - \Delta S_{kt}\Delta C_k) \end{aligned} \quad (3.5)$$

Thus

$$\Delta G_d = \textstyle\sum_k (S_{kt+1}\Delta C_k + C_{kt+1}\Delta S_{kt} - \Delta S_{kt}\Delta C_k) \quad (3.6)$$

On the other hand, inequality in period *t+1* can be expressed as:

$$G_{dt+1} = \textstyle\sum_k (S_{kt} + \Delta S_k)(C_{kt} + \Delta C_k) = G_{dt} + \sum_k (S_{kt}\Delta C_k + C_{kt}\Delta S_{kt} + \Delta S_{kt}\Delta C_k) \quad (3.7)$$

Thus

$$\Delta G_d = \textstyle\sum_k (S_{kt}\Delta C_k + C_{kt}\Delta S_{kt} + \Delta S_{kt}\Delta C_k) \quad (3.8)$$

Adding up (3.6) and (3.8) and divide by 2, it is easy to obtain:

$$\begin{aligned} \Delta G_d &= \sum\nolimits_k 0.5(C_{kt} + C_{kt+1})\Delta S_k + \sum\nolimits_k 0.5(S_{kt} + S_{kt+1})\Delta C_k \\ &= \textstyle\sum_k (C_k^* \Delta S_k + S_k^* \Delta C_k) \end{aligned} \quad (3.9)$$

where the starred variables represent the average of their values in the base and current periods. Equation (3.9) indicates that a change in inequality can be attributed to two components: (i) changes in the income shares, i.e., $\sum_k C_k^* \Delta S_k$; and (ii) changes in the concentration indices, i.e., $\sum_k S_k^* \Delta C_k$. In the context of regional inequality, the second component can be interpreted as the contribution arising from changes in spatial agglomeration. Clearly, each of these two components can be further broken down into *K* finer components.

It is important to point out that in reality changes in the income shares can be independent of changes in the distributions of individual income components. For example, suppose there was an increase in the *k*-th component income by *x* percent for everyone. Clearly, this does not affect the inequality of any component income including that of the *k*-th income as long as relative inequality measures are used. However, S_k is now greater and all other income shares will alter. If the *k*-th income is more equally distributed than the total income, the overall inequality following such an increase should drop, and vice versa. This change in the overall income inequality is solely and completely attributable to variations in the income shares.

So far, equations (3.4)–(3.9) are expressed or derived using S_k as income shares. Let N denote national population, since $S_k = u_k/u = N\,u_k/N\,u$ and when income sources are categorized by economic sectors, S_k then represents sector share in the national GDP. Consequently, equation (3.4) can be used to explore sector contributions to the overall inequality and equation (3.9) can be used to quantify the contributions of structural transformation to inequality changes. As a consequence, the first term of (3.9), $\sum_k C_k^* \Delta S_k$, can be called the structural effects and the second term, $\sum_k S_k^* \Delta C_k$, concentration or agglomeration effects. As previously discussed, the structural effects can appear even if within-sector inequalities do not change at all.

It is useful to reiterate the significance of equation (3.9): policy options to deal with structural effects could differ fundamentally from those to deal with concentration or agglomeration effects. In most developing countries such as the PRC, increases in inequality due to structural transformation (relative decline in agriculture is commonly observed in less developed countries) are inevitable as urbanization, industrialization, and service sector development take place. In other words, less developed countries and transitional economies almost certainly have to experience this kind of inequality increases led by structural transformation, sooner or later. Under this circumstance, any interventions to curb inequality rise induced by the structure change are inappropriate. On the other hand, the structural effects will diminish and finally disappear as an economy approaches its completion of structural adjustment, as predicted by our theoretical model of section 2, and confirmed by the empirical evidence presented in the next section.

4. STRUCTURAL CHANGE AND REGIONAL INEQUALITY IN CHINA: AN EMPIRICAL APPLICATION

Section 3 of this paper proposes a decomposition framework that can be used to identify and measure sector contributions to total inequality as well as the impacts of structural transformation on inequality changes. Combining the theoretical result of section 2 with the Kuznets hypothesis, three empirical regularities can be postulated: (i) Sector contributions to total inequality depend on their development status; that is, an emerging industry such as the tertiary sector in the PRC is expected to be inequality-increasing while a sunset industry such as the primary sector is predicted to play an equalizing role. Manufacturing's contribution to inequality will increase first, and then decrease. (ii) As far as the structural effects of inequality changes are concerned, the manufacturing sector is expected to be the dominant driver, followed by the service sector and finally the primary industry. But in recent years, the tertiary sector has become the dominant determinant. (iii) The structural effect is a quadratic function of economic structures—the inverted U shape. In particular, the structural effect is expected to converge to zero as industrialization approaches completion in the PRC.

To verify these regularities, the profiles of structural change and regional inequality in the PRC are provided in section 4.1. Section 4.2 explores sector contributions to the level of total regional inequality. This is followed by section 4.3, which analyzes changes in regional inequality, focusing on the structural effect. Section 4.4 models the overall and sector structural effects to test the second and third regularities; and finally, as a digression, we briefly discuss the recent declines in the total inequality in section 4.5.

4.1 Structural Transformation and Regional Inequality Profiles

The PRC's recent economic takeoff began with the official introduction of the agricultural production responsibility system in late 1978, which significantly raised incomes of farmers. Rural income growth stimulated demand for nonagricultural commodities, which provided the necessary condition for expanding the nonfarm sectors. By the mid-1980s, reforms were extended into cities and towns. These reforms plus the open-door strategy provided sufficient conditions for the expansion of the nonfarm sectors, particularly the manufacturing industry, including the enterprises in towns and villages. Industrial growth, in turn, generated employment opportunities for surplus labor in rural PRC, which led to further increases in the income and demand of rural households. The virtuous circle then sets in, reinforced by a series of reforms and further opening-up policies to take advantage of the global market and foreign direct investment. Thus, the so-called PRC miracle has emerged.

Accompanying the PRC miracle is swift structural transformation (Figure 3a). At the national level, the GDP share of the primary industry decreased from 54.6% in 1952, to 29.5% in 1977, and to 10.0% in 2012, while the corresponding share of the service sector increased from 22.6% to 28.2% and further to 46.1%. Meanwhile, the GDP share of the secondary industry grew from 22.8% in 1952 to 50.0% in 1977 and has since fluctuated between 40% and 52%. Looking forward, there is limited room for significant declines of the primary industry, especially given the commitments of the current leadership to food security and rural development. But the prominence of the service sector will continue to grow at the expense of the manufacturing sector.

Figure 3: Economic Structure (GDP Composition) of the PRC and Representative Provinces

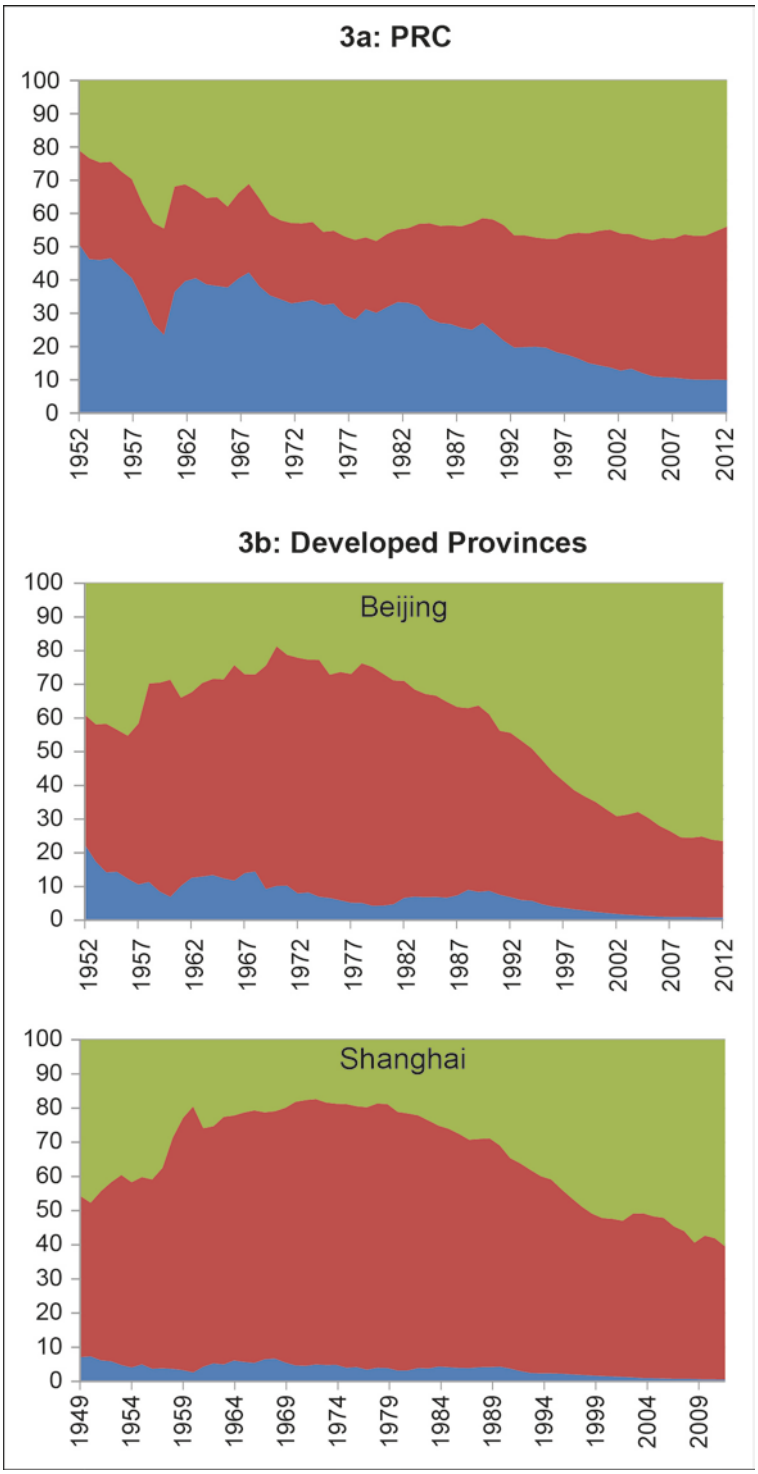


Figure 3 *continued*

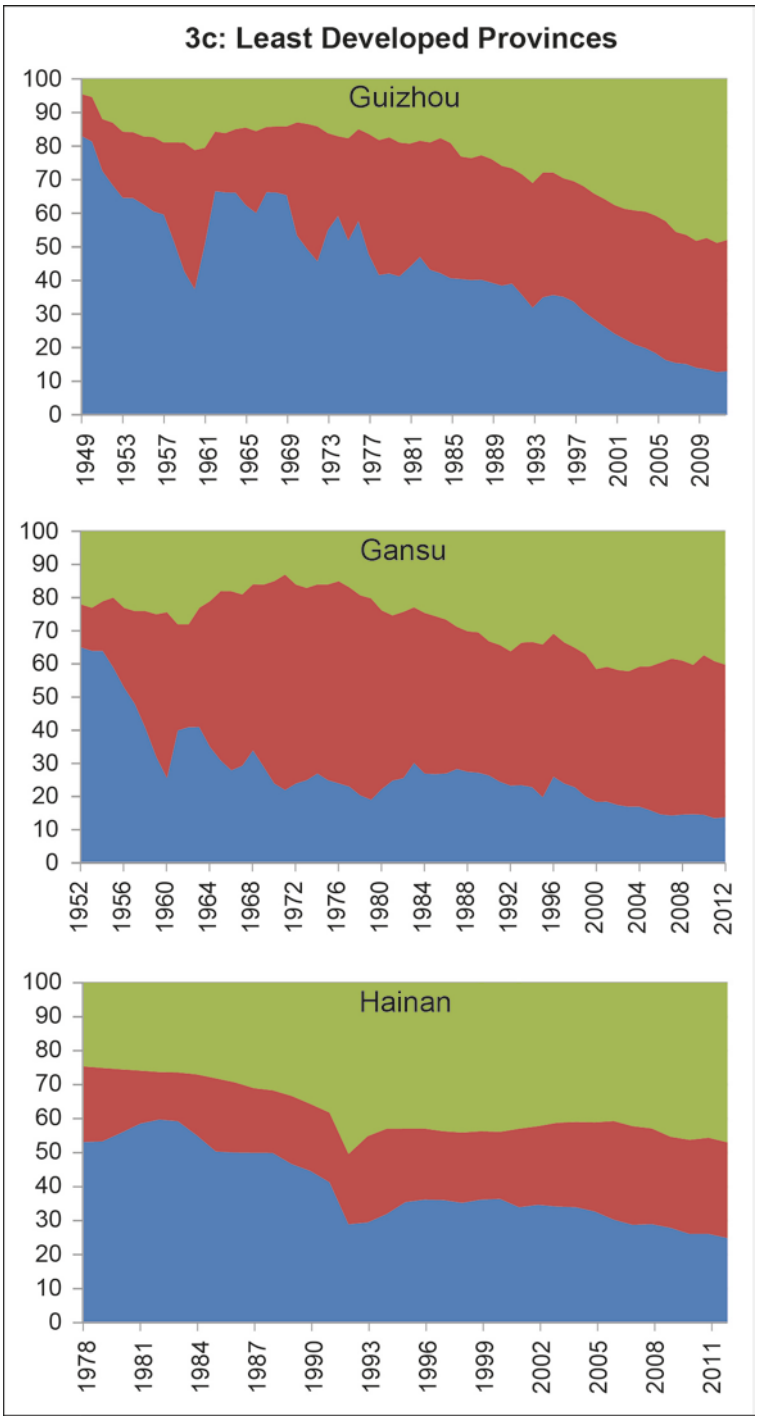
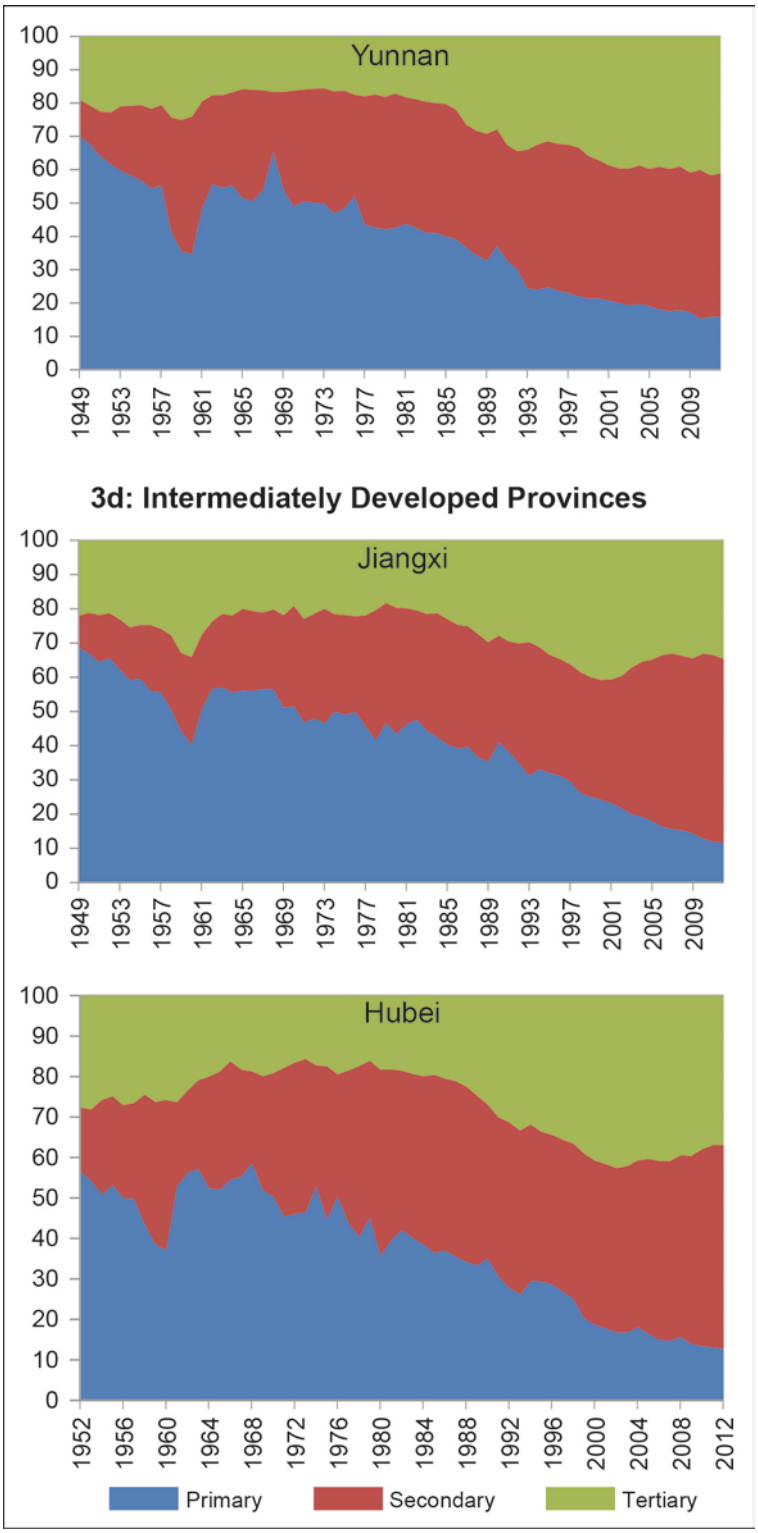


Figure 3 *continued*



GDP = gross domestic product; PRC = People's Republic of China.

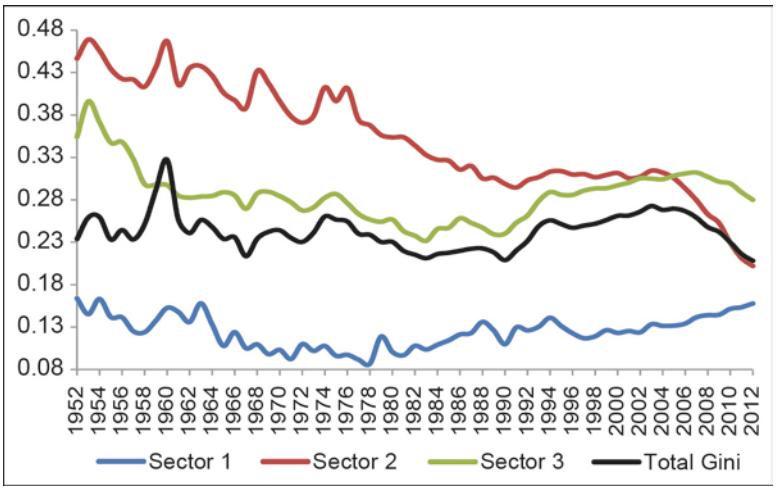
Source: National Bureau of Statistics (various years).

At the subnational level, the initial state of economic structure and the pace of structural transformation differed significantly from province to province. For example, in 1952 the primary sector occupied more than 75% of the provincial economy in Anhui, Ningxia, and Tibet but only around 20% in Liaoning, Beijing, Tianjin, and Shanghai. Figures 3b–3d depict structural changes of representative provinces. Represented by Beijing and Shanghai, more developed provinces have completed the industrialization process and are entering the service-dominant stage of development (Figure 3b). Other provinces, as represented by Guizhou, Gansu, Yunnan, and Hainan, saw little change in the share of the secondary industry, implying that these lagging provinces are yet to experience industrialization (Figure 3c). The remaining provinces displayed an increasing trend or a U-shaped pattern in terms of the industry share in GDP, as represented by Jiangxi and Hubei (Figure 3d). The disastrous effects of the Great Leap Forward (1958–1960) can be seen in all provinces.

As discussed above, structural changes are usually associated with resource flows. In particular, the much-publicized labor migration in the PRC has been gaining momentum since the mid-1990s, with migration mainly from agriculture to the manufacturing sector, from rural areas to cities, from small cities to large ones, and from inland areas to the coast. This unprecedented migration, now in the order of 270 million or more, must be driven by the high urban–rural average income ratio and significant wage gaps across industries and locations in the PRC. It is thus not surprising to witness, amid such resource flows and structural transformation, significant changes in income distribution along all dimensions in the PRC (Wang, Wan, and Yang 2014; Gustafsson, Li, and Sicular 2010; Wan 2008a and 2008b).

One particular dimension of the PRC's income distribution that has received considerable attention is regional inequality (Wan 2006 and 2007; Wan, Lu, and Chen 2007). Since different regions possess different endowments of resources, which also generate different returns in different sectors or locations, increases in regional inequality are not unexpected, as confirmed by Wan (2004 and 2007) among others. Figure 4 plots regional inequalities in per capita total GDP, as well as in sector per capita GDP, using the Gini coefficient as the measure of inequality.

Figure 4: Gini Estimates of per Capita Total GDP and Sector GDPs



GDP = gross domestic product.

Source: Authors' computation based on National Bureau of Statistics (various years).

Separating into pre- and post-reform periods (before and after 1978), overall regional inequality seems to have exhibited trendless fluctuations in the pre-reform period if the spike around 1960 is excluded. The spike in the 3 disastrous years of 1958–1960 can be attributed to the Great Leap Forward campaign, coupled with natural disasters. The infamous campaign aimed at "surpassing Britain and the United States" in terms of industrialization, which led to the sharp rise in the share of the secondary industry from 31.3% in 1957 to 39.9% in 1958, and 46.3% and 51.8% respectively in 1959 and 1960 before dropping back to 37.8% in 1961. Meanwhile, the natural disasters negatively impacted on the farming sector with GDP share of the primary industry dropping from 43.2% in 1957 to 36.8%, 29.7%, and 24.5% in 1958–1960 before recovering to 35.0% in 1961 (cf. Figure 3). These structural changes are most dramatic over the entire sample period, causing the largest changes in regional inequality in the People's Republic era (see Figure 7 and related discussions). In passing, it is noted that the spike mainly came from the contribution of the secondary industry (Figure 6). Leaving the spike aside, pre-reform regional inequality fluctuated within a small interval of (0.21, 0.26). The next pre-reform peak occurred in 1974, with a Gini value almost identical to those in 1953 and 1954. The pre-reform trough occurred in 1967 with a Gini value of 0.21.

The post-reform period saw a generally rising trend in regional inequality until recently. Its early decline from 1978 to the mid-1980s can be attributed to the household production responsibility system and increases in the procurement prices for grains, which helped narrow the urban–rural gap, which constitutes no less than 50% of total regional inequality in the PRC (Wan 2007). When reform focus was shifted to the urban sector in the mid-1980s, regional inequality began to rise, again due largely to the rising urban–rural gap. The sudden dip in 1990 could be partly attributable to the austerity policies implemented over 1989–1990. As Wan (2001) discovered, inequality in the PRC tends to drop during economic downturns, which may have also contributed to the inequality decline in recent years. The sharp increases in the mid-1990s followed the major taxation system reform of 1994, which provides rich (poor) regions with more (less) revenues for local redistribution and spending. The recent reductions since 2004 have been encouraging. But it is not clear whether these declines represent a short-term fluctuation like that in the early 1980s or a long-term trend as predicted by the Kuznets hypothesis (see the end of section 4.3 for more discussion).

The empirical results of this subsection help confirm the theoretical prediction of section 2 in the sense that structural change in the PRC characterized by industrialization was found to be accompanied by rising inequality until the early 2000s. As the PRC completes its industrialization process, inequality has begun to decline.

4.2 Economic Structure and Regional Inequality

Next, we discuss sector contributions to total inequality and identify which sector drives income distribution. Figure 4 indicates that the primary sector (sector 1) is the most evenly distributed across regions, especially from the mid-1960s to the early 1980s. Unlike in the primary industry, which has shown a linearly rising trend since 2003, inequality in the service sector (sector 3) had been growing continuously until 2007, when it began to drop. The secondary industry has always been converging over time, particularly since 2003. Manufacturing (sector 2) had been the most unequal sector until 2005, when the service industry became the most dispersed sector.

Further examination of Figure 4 reveals that total inequality closely correlated with that of the secondary industry until the mid-1980s. Since then, manufacturing inequality as indicated by its Gini coefficient has continued to decline against the rising trend of overall inequality. On the other hand, service sector inequality exhibited a trend that is remarkably similar to that of overall inequality except for the unusual 3-disastrous-years period. This co-movement is a little surprising as the PRC economy has been dominated by manufacturing for a long time. Note that the service sector's share of the economy will increase further largely at the expense of the secondary industry. In addition, while the secondary industry has always been converging, the service sector has been diverging since the early 1980s and the rate of increase in the divergence only moderated a little in recent years.

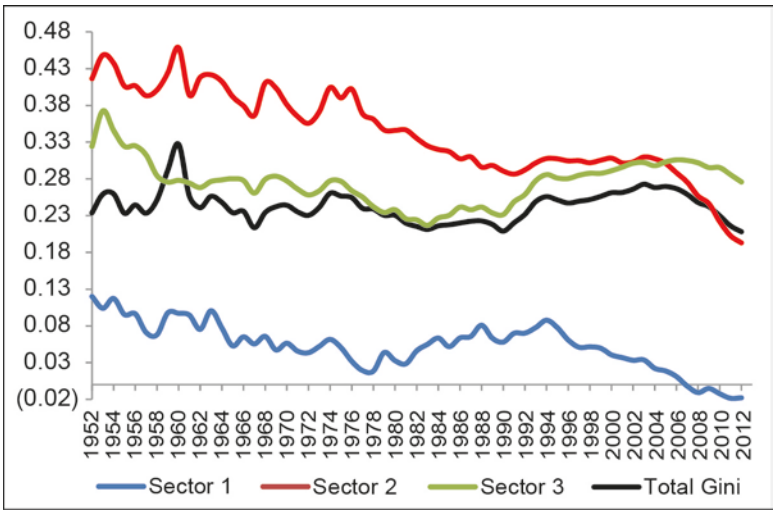
The above findings provide evidence to support the first regularity we postulated at the beginning of this section that the inequality of a sector is related to its growth status. For example, the correlation between manufacturing inequality and total inequality is high initially but gradually declines over time. Meanwhile, the service sector begins to play an increasingly dominant role in driving total inequality. If such correlations imply any causal mechanism, further rise in regional inequality may be under way once the convergence of the secondary sector reaches its stable state. These findings point to a cautious inequality scenario for the PRC as future growth will inevitably come with the expansion of the service sector, as indicated in Figure 3a.

Now, attention is turned to examining whether the manufacturing sector is inequality-increasing first and then inequality-decreasing. As discussed earlier, whenever a sector concentration index is greater than the total GDP Gini, it is inequality-increasing, and vice versa. Figure 5 plots the sector concentration indices along with the total GDP Gini estimates. All estimates of the concentration indices are positive except those for the primary industry in 2007–2012. In other words, with a few exceptions all GDP components are positively correlated with total per capita GDP, thus richer regions tend to possess higher per capita GDP in all sectors.

Conforming to the first regularity, the primary industry is found to be always equalizing. Concentration of the primary sector has been low and declining over time. Its decline has accelerated since the mid-1990s, with the concentration index dropping below 0 from 2007. This is likely to have been caused by the abolition of agriculture taxes in 2006, for the first time in the PRC's long history. Increasing government support to grain producers who are more likely to be poor may have also played a role. Also conforming to the first regularity, the tertiary industry (sector 3) has always been dis-equalizing, with the only exception of the 3-disastrous-years period of 1959–1961. Unlike the other two sectors, the service industry has been diverging since the early 1980s (Figures 4 and 5). This divergence, reinforced by the industry's rising GDP share, completely accounted for the increases in regional inequality from the mid-1990s to the mid-2000s (see Figure 6 and related discussions below).

More interestingly, the manufacturing sector had been inequality-increasing until 2009. But there is a declining trend in both its Gini (Figure 4) and its concentration indices (Figure 5), particularly from 2003 onward. This, once again, confirms the first regularity discussed above. The causes of such a convergence in the secondary industry are worth future research. One possibility lies in industrial relocation, driven by improved infrastructure and a rapid rise in production costs in coastal areas. If this is the case, the recently emerging equalizing effect of the secondary industry is expected to continue into the future. However, Lu and Xiang (2014) argued that the convergence may be a result of government interventions and thus may not be sustainable.

Figure 5: Sector Concentration Indices and the Total GDP Gini



GDP = gross domestic product.

Source: Authors' computation based on National Bureau of Statistics (various years).

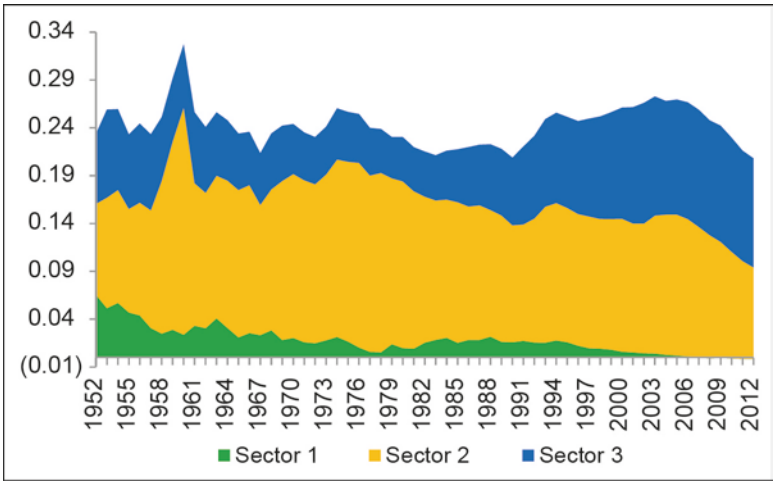
Contrasting Figures 4 and 5 reveals that for the service or the secondary industry, its Gini and concentration indices share a similar trend, even with similar values. The correlation coefficients between these two indices are as high as 0.997 for the manufacturing sector and 0.978 for the service sector. These imply that richer provinces have higher per capita GDPs from the nonfarming sectors. The primary industry's Gini and concentration indexes resembled each other until the late 1990s, but their trends have diverged in the last 10 years or so. The two indexes were positively correlated only until 1994, with a correlation coefficient 0.942. Adding the remaining later observations, the correlation coefficient drops to 0.198. For the latest period of 1995–2012, the correlation coefficient becomes –0.869. These results imply that per capita agriculture GDP has been higher in poorer regions only in recent years.

To obtain sector contributions to total inequality, equation (3.4) is applied to provincial population and sector GDP data[2], available from National Bureau of Statistics (various years). The results are shown in Figure 6. Figure 6 demonstrates that throughout the sample period, the secondary industry has played a dominant role in constituting regional inequality. Until the early 1990s, more than half of total regional inequality can be accounted for by the uneven development of the secondary industry. This is in line with popular perception. But what is unknown to many is the finding that the tertiary sector's contribution has been rising since the early 1980s, particularly after the mid-1990s. By the mid-2000s, rather surprisingly, it overtook the secondary industry as the most important contributor to regional inequality. In fact, all increases in total regional inequality from 1994 until 2003 came from the tertiary sector. On the other hand, most of the decreases in total regional inequality after 2004 came from the secondary, not the tertiary, industry. These empirical findings corroborate well with the two regularities and prediction of our theoretical model.

[2] Inequality is usually measured in terms of per capita income or consumption. However, only GDP data permit breakdowns into sector components for analyzing the structural effects. Income data by sectors or industries are not available. In any case, regional inequality based on GDP data shares the same trend as those based on income or consumption data (Wang, Wan, and Yang 2014).

As the concentration index of the service sector remains high (Figure 5), and its GDP share is expected to continue to rise, uneven development of the tertiary industry must receive priority consideration in the fight against regional inequality. On the other hand, the concentration index of the primary industry GDP has consistently been small and moved into negative territory as of 2007 (Figure 5) and its GDP share has been below 10% since 2009 (Figure 3a). Therefore, the contribution of the primary industry to regional inequality must be small and becoming negligible over time, as confirmed by Figure 6.

Figure 6: Sector Contributions to Regional Inequality



Note: On the y-axis, the Gini coefficient is shown.

Source: Authors' computation based on National Bureau of Statistics (various years).

4.3 Accounting for Changes in Regional Inequality: The Role of Structural Transformation

To account for inequality changes, equation (3.9) is applied to the PRC data. The decomposition results, as shown in Figure 7, demonstrate that the secondary industry has dominated not only the contributions to the level of total regional inequality, but also the contributions to changes in total inequality. In particular, the spike in the Great Leap Forward period is clearly attributable to the secondary industry. The contributions of the primary sector to inequality changes were visible in the pre-reform period but diminished over time and largely disappeared after 1990. The role of the service sector in driving inequality changes became more visible from the mid-1980s. However, this role lost significance in the last 7 years when total inequality declined, despite its rising and dominant contributions to total inequality (cf. Figure 6).

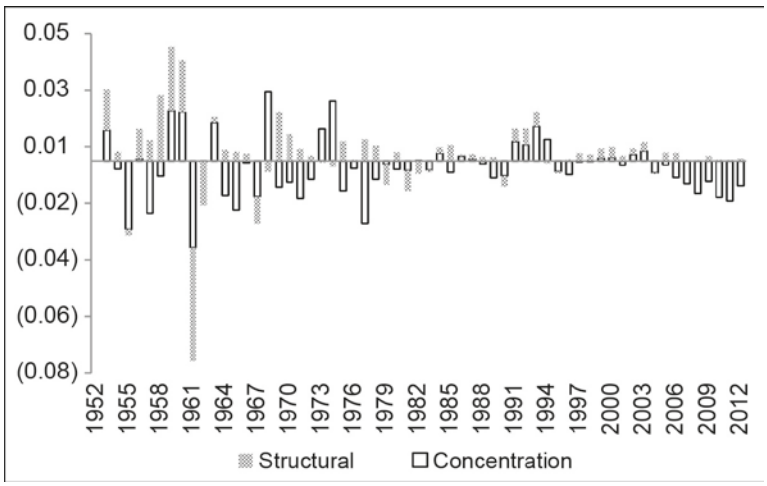
It is commonly accepted that year-to-year changes in inequality are typically small. However, our results demonstrate that small changes can accumulate rather quickly. There are four major peaks in total regional inequality in the PRC, appearing in 1960, 1974, 1994, and 2003. The first three were formed by only 2–3 years of successive small rises. The 2003 peak was preceded by 7 years of even smaller increases. More interestingly, the significant decline in regional inequality since 2004 is caused by 7 years of consecutive small decreases.

Figure 7: Sector Contributions to Changes in Regional Inequality

Note: On the y-axis, the Gini coefficient is shown.
Source: Authors' computation based on National Bureau of Statistics (various years).

Figure 8 shows the structural and concentration effects. It is interesting to observe the following: (i) Out of a total of 60 years, 49 years saw positive structural effects, meaning inequality-increasing. This finding confirms the theoretical postulation discussed in section 2 of this paper: structural change brings about inequality, making some people gain more while others gain less or even lose. (ii) Out of a total of 60 years, 34 years saw negative concentration effects. During 1968–1971, 1975–1981, and 2004–2012, they were successively negative and during 1991–1994 successively positive. No systematic pattern can be detected in other years. (iii) Prior to 2004, structural effects mostly co-moved with changes in total regional inequality, implying that regional inequality can be largely attributable to structural effects. For example, 1983 marks the year of division between decreasing and then increasing total inequality. And in the same year, we saw the negative and then positive values of the structural effects. (iv) There is a clear converging trend in the structural effects—the fluctuations becoming smaller over time, corresponding well with gradual movement toward completion of the industrialization process. This is better seen in Figure 9, which plots the cumulative structural and concentration effects.

Figure 8: Structural Effects and Concentration Effects of Inequality Changes

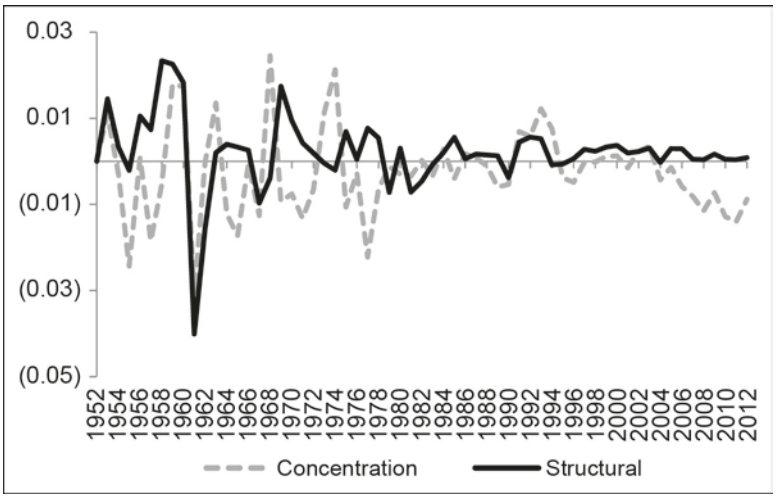


Note: On the y-axis, the Gini coefficient is shown.
Source: Authors' computation based on National Bureau of Statistics (various years).

Until 1972, the structural and concentration effects seemed to reinforce each other, with a 1-year lag or lead sometimes. They became offsetting to each other during 1973–1985. From 1985 to 2003, they were weakly but positively correlated. No obvious correlation can be found in the post-2003 period, when structural effects diminished to 0 while the concentration effects turned negative with a declining trend.

Figure 9 plots the cumulate structural and concentration effects, confirming that the structural effects were mostly positive. Up to the period of the Great Leap Forward, their absolute values were larger than those of the concentration effects. From 1961 to 1994, structural effects took alternate signs and their magnitude became small, smaller than the corresponding concentration effects in a majority of years, particularly after 1985. Since 1994, the structural effects have always been positive with only one exception, but their values have gradually converged to zero. During 2007–2012, structural effects can be hardly seen at all (Figure 8). But, in contrast to the diminishing structural effects over time, the concentration effects were relatively large from about 1982 onward and became dominant after 2006. These results help verify our theoretical model.

Figure 9: Cumulative Structural and Concentration Effects



Note: On the y-axis, the Gini coefficient is shown.

Source: Authors' computation based on National Bureau of Statistics (various years).

Which effects, the structural or concentration effects, are more important? Figure 8 indicates that the concentration effects in absolute terms are larger most of the time. Further, Figure 9 shows that in more recent years, they drove the decline in total regional inequality (section 4.4). Thus, it can be concluded that concentration effects basically dominated the regional inequality profile in the PRC. As mentioned previously, structural effects, by definition, are indispensable to growth and they form part of the growth regularity. Fortunately, the structural effects are converging to 0, corroborating the observation that the industrialization phase of structural transformation is approaching completion in the PRC. This is consistent with the very hypothesis that motivated this paper.

4.4 Modeling the Structural Effects

To formally verify regularities 2 and 3, we conduct regression analysis in this subsection. First-order differences are taken for all variables in case they have unit roots. Data before 1961 are excluded as the 3 disastrous years can be treated as outliers. To model the overall structural effect, the following regression can be specified:

$$SE = \alpha + \beta_1 DS_1 + \beta_2 DS_2 + \beta_3 DS_3 + \varepsilon \quad (4.1)$$

where α and βs are parameters, *SE* = overall structural effect, DS_k = GDP shares of the *k*-th sector, and ε represents the error term. Recall that all variables are being differenced before entering the model. Since the independent variables add up to 0, it is sufficient to estimate any two of the following three models:

$$SE = \alpha + (\beta_1 - \beta_3) DS_1 + (\beta_2 - \beta_3) DS_2 + \varepsilon_1 \quad (4.2)$$

$$SE = \alpha + (\beta_1 - \beta_2) DS_1 + (\beta_3 - \beta_3) DS_3 + \varepsilon_2 \quad (4.3)$$

$$SE = \alpha + (\beta_2 - \beta_1) DS_2 + (\beta_3 - \beta_1) DS_3 + \varepsilon_1 \quad (4.4)$$

Table 1 tabulates the estimation results for the first two models (columns 1 and 2). It is easy to find that the estimate of β_2 is larger than that of $\beta_3$which in turn is larger than β_1. This confirms the second regularity and is consistent with the current state of the PRC economy: industrialization has been the main feature of the PRC's structural transformation and thus the manufacturing industry has dominated the structural effects. However, at the national level, industrialization is approaching its end and the service industry is emerging as the dominating sector. To see if the two sectors had swapped their roles in driving the structural effect, model (1) was re-estimated using more recent data. The estimation results in the last column of Table 1 confirm the swapping.

Table 1: The Impacts of Structural Transformation on Overall Changes in Inequality

Model	**(1)**	**(2)**	**(1)**
Data Coverage	**1961–2012**	**1961–2012**	**2003–2012**
DS_1	–0.210***	–0.309***	–0.289***
	(0.0124)	(0.0105)	(0.0290)
DS_2	0.0994***		–0.0370**
	(0.0137)		(0.0150)
DS_3		–0.0994***	
		(0.0137)	
R^2	0.970	0.970	0.951

Note: Robust standard errors in parentheses; and ***, **, * indicate level of significance at 1%, 5%, and 10%, respectively.

Source: Authors' computation based on National Bureau of Statistics (various years).

Our theoretical model implies that inequality changes that are attributable to structural transformation display an inverted U shape (third regularity). To test this implication, we simply regress sectoral structural effect on sectoral GDP share and its square. The estimation results are presented in Table 2. Considering the diminishing importance

of the primary sector, it is not surprising that the quadratic term is insignificant when the whole data sample is used. But when the data is limited to 1990, the quadratic term becomes significant. Similarly, the tertiary sector is gaining prominence, thus using the entire sample data yields the left half of the predicted U shape. More recent data confirm the U shape. In short, Table 2 provides clear evidence, supporting our theoretical model or regularity 3.

Table 2: The U-Pattern between Structural Effect and Structural Change

	Models for				
	Sector 1	**Sector 1**	**Sector 2**	**Sector 3**	**Sector 3**
	1961–2012	**1961–1990**	**1961–2012**	**1961–2012**	**2003–2012**
DS	0.0932***	0.143***	0.622***	0.206***	1.419***
	(0.0281)	(0.0390)	(0.0484)	(0.0122)	(0.373)
DS^2	–0.0253	–0.0990*	–0.300***	0.106***	–1.384**
	(0.0351)	(0.0526)	(0.0603)	(0.0183)	(0.461)
R^2	0.931	0.942	0.991	0.995	1.000

Note: Robust standard errors in parentheses; and ***, **, * indicate level of significance at 1%, 5%, and 10%, respectively.

Source: Authors' computation based on National Bureau of Statistics (various years).

4.5 Recent Declines in Regional Inequality: A Digression

The consecutive declines in regional inequality after 2005 deserve some attention. This decline also appears when household or individual data are used. It thus makes sense to shed some light on this important trend. To provide more insight, the structural and concentration effects are disaggregated by sectors. The results are tabulated in Table 3 (with percentage contributions adding up to 100). It is clear that the declines are basically driven by significant reductions in industry concentrations, particularly that of the secondary industry and to some extent that of the service industry. If one adds up these two reductions, the combined contribution accounts for at least 85% of each of the declines in regional inequality over the period 2006–2012. Conversely, the structural effects are mostly inequality-increasing but they are all quite small. What drives the convergences in industry concentration is a question worth further research, but industry relocation and increasing flows of foreign direct investment to the inland provinces over the last few years are part of the explanation.

Table 3: Recent Declines in Regional Inequality: Decomposition Results (%)

		Concentration Effects			**Structural Effects**			
From	**To**	**Sector 1**	**Sector 2**	**Sector 3**	**Sector 1**	**Sector 2**	**Sector 3**	**Sum**
2005	2006	–27.57	–206.57	38.02	–5.09	85.84	15.37	–100
2006	2007	–17.44	–83.98	–4.54	–0.09	–4.15	10.18	–100
2007	2008	–8.00	–83.77	–11.51	0.10	12.53	–9.35	–100
2008	2009	9.71	–93.12	–46.32	0.57	–41.66	70.83	–100
2009	2010	–5.43	–98.12	–0.24	0.26	20.16	–16.63	–100
2010	2011	–4.14	–70.40	–28.15	0.20	3.26	–0.76	–100
2011	2012	0.72	–60.39	–51.09	0.04	–24.28	35.00	–100

Source: Authors' computation based on National Bureau of Statistics (various years).

5. SUMMARY AND CONCLUSION

This paper postulates that structural changes triggered by technological (e.g., emergences of information and communication technology and e-commerce), cultural (e.g., rising demand for health food), institutional (e.g., the PRC's reform and opening up), or policy (e.g., a privatization move) shocks bring about resource reallocation across sectors and locations, leading to disequilibriums in factor demand and supply and thus causing changes in income inequality. As structural transformation slows down or approaches its completion, equilibriums tend to be restored and inequality tends to decline. We construct a model to characterize this process, demonstrating relationship of inverted U shape between inequality and structural transformation. Our theoretical model is different from the famous Kuznets hypothesis as Kuznets (1955) focused on the growth–inequality relationship, which was not formalized either. It is also different from the convergence or catch-up literature, including Caselli and Coleman (2001).

Decomposition frameworks are then developed to account for the level of inequality and for the changes in the level of inequality. A change in inequality can be attributed to structural transformation (called structural effect) and variation in concentration indexes (called concentration effect). According to our theoretical model, the structural effects are expected to be positively correlated with structural transformation and tend to disappear when the latter approaches completion. These theoretical predictions are confirmed by empirical evidence from the PRC.

Applying the decomposition technique to PRC data yields several fresh, interesting, and important findings. First of all, the structural effects mostly co-moved with changes in total regional equality before 2004. But it has recently converged to 0, confirming our theoretical postulation that motivated this paper. Conversely, the concentration effects became relatively large after 1982 and became dominant after 2006.

Second, the primary industry has always been equalizing while the tertiary industry has always been dis-equalizing except the unusual 3-year period of 1959–1961. The manufacturing sector had accounted for more than half of the total regional inequality until the early 1990s and had been dis-equalizing until 2009. It also dominated sectoral contributions to inequality changes. But this important sector has always been converging spatially, particularly after 2003.

Third, the service industry has been spatially diverging since the early 1980s. By the mid-2000s, it overtook the secondary industry as the most important contributor to regional inequality. In fact, all increases in total regional inequality from 1994 until 2003 came from the tertiary sector. In addition, total regional inequality has closely co-moved with that of the service sector since 1966. Because its GDP share will rise further, coupled with a high concentration index, uneven development of the tertiary industry must receive priority consideration in the fight against regional inequality in the future, especially when the secondary sector converges to its stable state.

Finally, the structural and concentration effects are found to reinforce each other until 1972. They became offsetting to each other during 1973–1985. From 1985 to 2003, they are weakly but positively correlated. Little correlation can be found after 2003 when structural effects diminished to 0 while the concentration effects turned negative with a declining trend.

These findings have profound implications for the PRC. Fast-rising inequality in the PRC has largely been driven by structural transformation, which is indispensable to growth and forms part of the growth regularity. But the structural effects have basically disappeared and the concentration effects are becoming dominant. Looking forward, the poorer inland areas in the PRC possess comparative advantages in producing agricultural and mining products. As the share of the equalizing primary industry diminishes (see Figure 4 and its related discussion), regional inequality is likely to rise. On the other hand, services are less tradable than commodities, thus the location advantage of coastal regions in manufactured exports is expected to decline as the GDP share of the tertiary sector rises. Consequently, regional inequality may decrease or increase as the PRC continues to transform from a manufacturing-dominant to a service-dominant economy, partly depending on the emerging structural effects that will be driven by the increasing dominance of the service sector. Thus, it is important to support the development of the tertiary sector in the lagging areas so as to alleviate the potentially rising concentration effects.

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APPENDIX: TWO-SECTOR GINI COEFFICIENT

The Gini coefficient is the ratio of the area between the line of perfect equality and the Lorenz curve over the total area under the perfect equality line. The latter is simply 0.5.

In this paper, the population is divided into two groups, assuming away any within-group income gaps. In this case, the Lorenz curve becomes a broken line (Figure A1) and the corresponding Gini coefficient can be expressed as:

$$G = (0.5 - (B + C + D))/0.5 \quad \text{(A.1)}$$

Using the notations defined in the paper, it is easy to show that:

$$B = 0.5 \times \frac{L_r}{L} \times \frac{w_r L_r}{w_r L_r + w_m L_m} \quad \text{(A.2)}$$

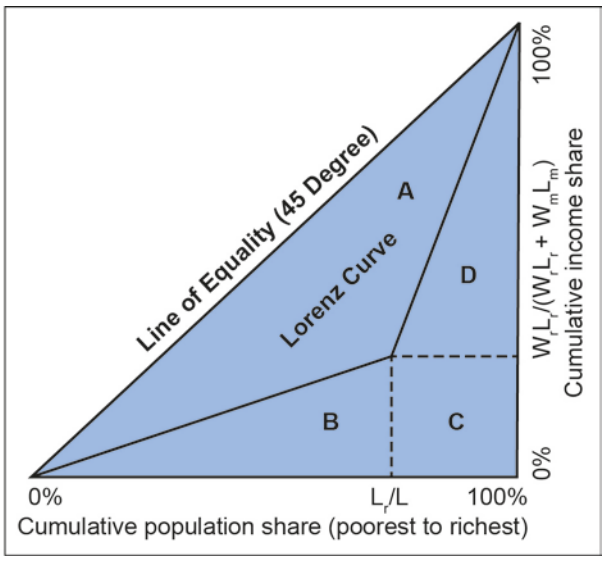
$$C = \left(1 - \frac{L_r}{L}\right) \times \frac{w_r L_r}{w_r L_r + w_m L_m} \quad \text{(A.3)}$$

$$D = 0.5 \times \left(1 - \frac{L_r}{L}\right) \times \left(1 - \frac{w_r L_r}{w_r L_r + w_m L_m}\right) \quad \text{(A.4)}$$

Thus:

$$G = 1 - 2(B + C + D) = \frac{w_m L_m}{w_r L_r + w_m L_m} - \frac{L_m}{L} \quad \text{(A.5)}$$

Figure A1: Two-Sector Income Distribution



Source: Authors' adaptation.